Moving forward with dementia

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CHAPTER 2

PREDICTORS OF CARE DEPENDENCY IN NURSING HOME RESIDENTS WITH MODERATE TO SEVERE DEMENTIA: A CROSS-SECTIONAL STUDY

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ABSTRACT

Background. Nursing home residents with dementia show a rapid decline in their ability to perform activities of daily living. This decline is linked to a greater care dependency, which is associated with a reduced quality of life. Care dependency is influenced by multiple predictors, yet current research often focuses on the contribution of a single or a small number of predictors of care dependency.

Objectives. To examine the contribution of multiple predictors in predicting care dependency.

Design. The present study analyzed baseline data from a 6-month double-parallel randomized controlled trial which examined the effect of three physical activity interventions on multiple outcomes.

Setting. This study was conducted in eleven nursing homes in Bergen op Zoom, the Netherlands.

Participants. In total, 85 nursing home residents with moderate to severe dementia were included in the study, of which 75 were included for analysis.

Methods. Predictors considered were cognitive, physical, neuropsychiatric, demographic, and disease related factors. The outcome measure care dependency was assessed with the Care Dependency Scale and the Erlangen Test of Activities of Daily Living. Linear multilevel regression analyses were used to identify the most important predictors of care dependency.

Results. Apathy, physical endurance, number of comorbidities, and global cognition were significant predictors of care dependency. The model explained 66% of the variance in care dependency. Global cognition was a significant predictor of ability to perform activities of daily living and explained 60% percent of its variance.

Conclusion. The present study shows that multiple predictors (i.e., apathy, cognitive and physical abilities, and disease-related factors) contribute to predicting care dependency. Future research could focus on the effectiveness of multifactorial interventions to maintain the highest possible level of independence in nursing home residents with dementia.

INTRODUCTION

Older persons with dementia often display a progressive deterioration in activities of daily living (ADL).[1] ADLs are functional tasks which are important for independence in self-care and functioning. Especially nursing home (NH) residents with dementia show a faster than expected decline in ADL ability,[2, 3] and this decline in functional abilities is inevitably linked to a greater care dependency.[4] Care dependency occurs when a patients' self-care abilities (e.g., eating and drinking, hygiene, dressing, social contacts) have decreased to such an extent that they are, to some degree, dependent on nursing care.[5] In some studies, dependency has been defined as a composite measure of functional disability, while others conclude that dependency is strongly associated with, but not defined by, functional disability.[6] An increase in care dependency is closely related to the development of dementia[7] and health related nursing care problems (i.e., malnutrition, pressure ulcers, incontinence, falls, restraints).[8] For instance, dependency in eating and drinking may lead to nursing care problems like malnutrition. Moreover, care dependency is associated with a reduced quality of life[9, 10] and high caregiver burden.[11] Since dementia is one of the most common disorders in the NH,[8] and NH residents with dementia show a significantly higher degree of, and a faster decline in care dependency than NH residents without dementia,[12, 13] it is relevant to identify predictors of care dependency in NH residents with dementia. This knowledge can help target multifactorial interventions to support the patients' highest level of independence in order to stabilize care dependency in dementia.

Care dependency or functional disability has been related to the severity of dementia,[4, 14, 15] and multiple demographic predictors, such as age and gender,[16-18] cognitive and physical abilities,[1, 4, 10, 14, 18-24] neuropsychiatric factors,[10, 11, 14, 25] and medical comorbidities in persons with mild to moderate dementia.[10] Despite the available evidence that care dependency is related to multiple predictors, previous research mostly examined the contributions of only a single predictor or a small number of predictors.[4, 10, 16, 18, 24] Consequently, the contribution of multiple predictors on care dependency, and which predictors are most influential, remains relatively unknown. The predictors that have been most consistently reported in the literature are cognitive abilities[1, 4, 20-22, 25] and disease severity measured by the Mini-Mental State Examination (MMSE),[15, 24, 26] which indicates that cognitive abilities may be important predictors of care dependency.[24] However, it was shown that cognitive abilities accounted for only a limited amount of variance in care dependency (ranging from 11 to 37%), suggesting that other predictors may also contribute to dependency.[16, 24]

Besides studies focusing on a limited number of predictors, the majority of the studies into predictors of care dependency focused on persons with mild to moderate dementia, while few studies focused on moderate to severe dementia.[16] One study that did investigate,

but was not limited to, persons with moderate to severe dementia found that cognitive function, functional capabilities, and behavioral symptoms were significant predictors of care dependency for the group as a whole.[10] It is clinically relevant to investigate different stages of dementia, since independent functioning deteriorates differently during the progression of dementia, and therefore findings in mild to moderate dementia may not apply to the overall patient group.[27, 28] Specifically, ADL functions seem largely preserved in mild cognitive impairment,[18] whereas early stages of dementia are particularly characterized by a decline in complex ADLs (e.g., using the telephone) and later stages of dementia by basic ADLs (e.g., bathing).[27] In addition, different predictors may affect care dependency differently depending on the stage of dementia. For example, the ability to perform complex ADLs appears to rely more on cognitive functions (e.g., planning), whereas basic ADLs rely more on physical abilities (e.g., balance).[27] Considering this stage-dependent variability in ability to function independently, and the potential changing relation with predictors throughout the course of the disease, it is relevant to examine NH residents with moderate to severe dementia separately.

In sum, the contribution of multiple predictors on care dependency in persons with dementia is still unknown, and particularly in persons with moderate to severe dementia. Therefore, the present study focuses on NH residents with moderate to severe dementia, and aimed to examine the contribution of multiple predictors in predicting care dependency.

METHODS

Study design and population

The present study analyzed the collected baseline data from a 6-month double-parallel randomized controlled trial (RCT) which examined the effect of three physical activity interventions (i.e., ADL training, exercise training, and a combined ADL and exercise training) on multiple outcomes.[29] In total, 87 participants were included in the RCT based on inclusion and exclusion criteria. Details on enrollment, intervention procedures, and the results of the interventions have been described previously.[29] Study inclusion criteria were: (1) living on a psychogeriatric ward of NH "tanteLouise" in the Netherlands, (2) diagnosis of dementia, (3) functional mobility level A or B (according to the Arjo Mobility Gallery),[30] (4) age ≥ 65 years, (5) a score on the Mini-Mental State Examination (MMSE)[31] between 1 and 24, and (6) able to complete the six-minute walk test (6MWT)[32] (with or without walking aid). Exclusion criteria were (1) wheelchair bound, (2) very poor vision, (3) severe cardiovascular problems, (4) unstable diabetes mellitus, or (5) aggressive or runaway behavior. The medical and physical capabilities of the residents were carefully examined by their geriatrician to ensure safe participation in physical interventions.

Even though the interventions are beyond the scope of this paper, a short description is given since it has influenced our selection of participants. In the ADL training, nursing staff stimulated movement by encouraging participants to perform as much of their self-care as independently as possible throughout the day. In the multicomponent exercise intervention, participants performed strength and aerobic exercises guided by qualified movement teachers, with a frequency of three times per week, for 30-45 min per session. Ethical approval was granted by the scientific and Ethical Review Board (VCWE) of the Faculty of Behavior & Movement Sciences of VU University Amsterdam (VCWE-2015-183R1). Participants' legal representatives (i.e., partner, family member, or curator) gave written informed consent prior to inclusion.

Measurement methods

For this study, the outcome measures collected at baseline of the RCT were assessed. The CDS, depression, apathy, and agitation questionnaires were completed by the participants' first responsible caregivers. The E-ADL, cognitive, and physical tasks were administered by trained neuropsychology and human movement science students.

Care dependency

Care dependency was measured in two ways: (1) a caregiver-rated questionnaire and (2) a performance-based test which measured the patients' ability to independently carry out ADLs.

The Care Dependency Scale (CDS, scored 15-75)[33] is a 15-item caregiver-rated questionnaire concerning a person's level of care dependency with regard to eating and drinking, continence, body posture, mobility, day and night patterns, getting dressed and undressed, body temperature, hygiene, danger avoidance, communication, contact with others, sense of rules and values, daily activities, recreational activities, and learning abilities. Higher scores indicated a higher level of independence.[34] The CDS is reliable (Cronbach's alpha 0.97; inter-rater reliability 0.51-0.71) and has a strong hierarchical scale (*H*-coefficient 0.75).[34, 35]

The Erlangen ADL (E-ADL, scored 0-30)[36] was used to measure functional disability. The E-ADL is a performance-based test in which residents are asked to perform five basic ADL tasks; pouring a drink, spreading butter on bread, opening a cabinet, washing the hands, and tying a bow. Higher scores indicated better ability to carry out ADLs.[36] The E-ADL has a high validity and a good reliability (Cronbach's alpha 0.77; test retest reliability 0.73).[36]

Predictors of care dependency

Candidate predictors were selected *a priori* based on variables found to be associated with dependence in previous literature.

Demographics

The following characteristics were considered: age, gender, educational level, and total number of comorbidities. Educational level was categorized as low (score 1-3), medium (score 4-5), or high (score 6-7) using the classification of Verhage.[37] Comorbidities were derived from the patients' medical charts, and were categorized according to the Dutch translation of the Long-Term Care Facility Resident Assessment Instrument (RAI), section I disease diagnosis.[38] The section consists of 44 subcategories that belong to eight categories: (1) endocrine/ metabolic diseases, (2) cardiovascular diseases, (3) diseases of the musculoskeletal system, (4) neurological diseases, (5) sensory impairments, (6) psychiatric/mood disorders, (7) pulmonary diseases, and (8) other diseases, including allergies, anemia, cancer, and renal failure. The neurological subcategories 'Alzheimer's disease' and 'Dementia, other than Alzheimer's disease' were not included, as these subcategories are part of the inclusion criteria. For each participant, the total number of comorbidities was calculated.

Cognitive factors

Cognitive functioning was measured with the MMSE[31] and the Severe Impairment Battery - Short Form (SIB-S).[39] The MMSE consists of 20 items, with scores ranging from 0 to 30. The internal consistency of the MMSE as indicated by the Cronbach's alpha varies between 0.54-0.96.[40] The SIB-S consists of 26 items, with scores ranging from 0 to 50. The internal consistency of the SIB-S is very high (Cronbach's alpha 0.97).[41] Executive functioning (EF) was measured with the category fluency subtest of the Groninger Intelligentie Test[42] and the Wechsler Digit Span Task backward (DSB).[43] The category fluency task and DSB were administered only to participants with an MMSE score of 5 or higher. For all cognitive measures, higher scores indicated better cognitive functioning.

Physical factors

Physical endurance was measured with the six-minute walk test (6MWT).[32] The outcome measure was the total walking distance in meters. Higher scores indicated better performance. Functional mobility was measured with the timed up and go test (TUG).[44] The outcome measure was the time (in seconds) it took to stand up from a chair, walk three meters, turn, return to the chair, and sit down. Lower scores indicated better performance. Handgrip strength was measured with the Jamar hand dynamometer,[45] where higher scores indicated better grip strength. Dynamic balance was measured with the Figure-of-8 walk test (F8W).[46] The outcome measure was number of steps and time taken to walk in a figure of eight around two cones placed 1.5 m apart. Static balance was measured with the Frailty and Injuries: Cooperative Studies of Intervention Techniques- 4 scale (FICSIT-4), which measured balance in parallel, semi-tandem, and one-legged stances.[47] Higher scores represented better balance.

Mood and behavior

Depressive symptoms were measured with the Cornell Scale for Depression in Dementia (CSDD). The questionnaire consists of 19 items rated on a two-point scale (range 0-38). Higher scores indicated more depressive symptoms.[48] The CSDD has a high internal consistency (Cronbach's alpha 0.84) and is sufficiently valid in persons with dementia.[49, 50] Apathy was measured with the Apathy Evaluation Scale-10 (AES-10). The questionnaire consists of 10 items rated on a four-point scale (range 10-40). Higher scores indicated more apathetic behavior.[51] The internal consistency of the AES-10 is high (Cronbach's alpha 0.95).[52] The frequency of agitated behaviors was measured with the Cohen-Mansfield Agitation Inventory (CMAI). The questionnaire consists of 29 items rated on a 7-point scale. Symptoms were clustered into four scales, i.e. aggressive behavior (scored 9-63), physically nonaggressive behavior (scores 6-42), verbally agitated behavior (scored 5-35), and other behavior (scored to 9-63). For each participant, a total CMAI score was calculated. Higher scores indicated more agitated behaviors.[53, 54] The internal consistency of the CMAI is high (Cronbach's alpha 0.83).[55]

Statistical analysis

Statistical analyses were performed using IBM Statistical Package for the Social Sciences (SPSS) 24.0. Assumptions of a linear regression model were not violated. Cooks distance revealed no outliers (values >1 were considered outliers). Participants with missing data on one or more variables were excluded from the analyses. A 'balance' domain was created which is the average of the sum of the z-scores of the F8W and the FICSIT-4. A dummy variable was created for educational level. The Cronbach's alpha was calculated for all multi-item scales and showed that all scales had an acceptable to good internal consistency (Cronbach's alpha range: 0.729-0.909), except for the E-ADL which had a poor internal consistency (Cronbach's alpha 0.485). A two-level regression model was used where participants (level 1) were nested within NHs (level 2). The maximum likelihood method was used to examine the possible superiority of random intercept and slope models. The model of the best fit was used for the final analyses. Simple and multiple linear regression models were performed separately for two measures of dependence (i.e., CDS and E-ADL). First, simple linear regression analyses were conducted for all variables to screen for candidate predictors of care dependency. Candidate predictors with *p*-values lower than .10 were included in the multiple regression analysis. Second, a multiple linear regression analysis was performed using a backward stepwise regression method to identify the most important predictors of care dependency. Significance levels of the multiple linear regression analyses were set at $p < .05$. There was a relatively large percentage of missing data (32.3%) on four candidate predictors (i.e., category fluency, DSB, balance, and level of education). Category fluency and DSB was often missing since EF tasks were only administered to persons with an MMSE score of 5 or

higher. Missing data of educational level was the result of the legal representatives' who were not aware of the educational level of the participants. Reasons for missing data on balance tasks were unknown. These four candidate predictors were excluded from the analyses in order to preserve the sample size. An additional subgroup analysis was conducted including these four candidate predictors in order to determine their contribution in the prediction of CDS and E-ADL scores.

RESULTS

Demographic and clinical characteristics of the participants are shown in **Table 1**. The mean global deterioration score (GDS) indicates a moderate to severe stage of cognitive decline. The mean CDS score was 50.2, which indicates that participants are partially dependent on nursing care.[56] **Table 2** shows the results of the simple linear regression analyses between candidate predictors and the CDS and E-ADL scores.

Care Dependency Scale (CDS)

In the simple regression analyses, significant associations were found for nine predictor variables and the CDS score. The apathy score (β = -0.67) and the 6MWT (β = 0.66) showed the strongest association with the CDS score. Results of the multiple regression model of predictors of CDS are shown in **Table 3.** Backward stepwise procedures showed that the apathy score (β = -0.43), 6MWT (β = 0.40), total number of comorbidities (β = -0.19), and the MMSE (β = 0.18) were significant, independent predictors of care dependency. These predictors explained 66% of the variance in CDS score. Apathy and the 6MWT were the most important predictors.

E-ADL

In the simple regression analyses, significant associations were found for eight predictor variables and the E-ADL score. The association was strongest for the SIB-S (β = 0.76) and the MMSE (β = 0.69). Results of the multiple regression model of predictors of E-ADL are shown in **Table 3**. Backward stepwise procedures showed that the SIB-S (β = 0.55) and the MMSE (β = 0.28) were significant, independent predictors of ADL disability. Sixty percent of the variance in E-ADL score was accounted for by the full model.

Table 1. Descriptive statistics for demographic and clinical variables (N = 75)

Variables	Participants
Age, mean *(SD)*	85.72 (5.71)
Gender (female), *n* (%)	59 (78.7%)
Education, *n (%)*	
Low (1-3)	24 (32%)
Medium (4-5)	39 (52%)
High (6-7)	6 (8%)
Diagnosis, *n* (%)	
Alzheimer's disease (AD)	29 (38.7%)
Vascular dementia (VD)	11 (14.7%)
Mixed AD and VD	6 (8.0%)
Other	28 (37.3%)
Unknown dementia type	1 (1.3%)
Total number of comorbidities, mean (*SD*)[b]	4.56 (1.94)
GDS, mean (*SD*)	5.24 (0.81)
GDS classification	
1: No cognitive decline	0
2: Very mild cognitive decline	0
3: Mild cognitive decline	3 (4%)
4: Moderate cognitive decline	8 (10.7%)
5: Moderately severe cognitive decline	30 (40%)
6: Severe cognitive decline	31 (41.3%)
7: Very severe cognitive decline	0
Missing	3 (4%)
CDS, mean (*SD*)	50.15 (11.20)
E-ADL, mean (*SD*)	22.52 (7.17)
Cognitive factors, mean (*SD*)	
MMSE	12.69 (5.48)
GIT[a] (n = 59)	5.09 (2.98)
SIB-S	40.80 (7.53)
DSB (n = 59)	4.56 (2.08)
Physical factors, mean (*SD*)	
6MWT	209.54 (74.01)
HHD	16.54 (8.36)
TUG	24.75 (11.92)
Z-score balance[a] (N = 59)	0.02 (0.88)
Mood and behavioral factors, mean (*SD*)	
CSDD	7.92 (4.48)
CMAI	48.45 (14.32)
AES	25.29 (7.24)

Note. [a] Z-score balance included figure of eight test, Frailty and Injuries, cooperative Studies of Intervention Techniques- 4 scale. [b]Endocrine/metabolic diseases (i.e., diabetes mellitus, hypothyroidism, hyperthyroidism), cardiovascular diseases (i.e., arteriosclerotic disease, arrhythmias, heart failure, deep vein thrombosis, hypertension, hypotension, peripheral vascular disease, other), diseases of the musculoskeletal system (i.e., rheumatic diseases, hip fracture, amputation, osteoporosis, pathologic bone fracture), neurological diseases (i.e., aphasia, cerebral palsy, stroke, hemiplegia/hemiparesis, paraplegia, multiple sclerosis, Parkinson disease, seizures, transient cerebral ischemia, traumatic brain injury, quadriplegia), sensory impairments (i.e., cataract, diabetic retinopathy, glaucoma, macular degeneration), psychiatric/mood disorders (i.e., anxiety disorder, depression, manic depression, schizophrenia), other diseases (i.e., asthma, emphysema/COPD, allergies, anemia, cancer, renal failure).
Abbreviations. GDS, Global deterioration scale; CDS, Care dependency scale; E-ADL, Erlangen activities of daily living; MMSE, Mini-Mental State Examination; GIT, Groninger intelligentie test; SIB-S, Severe Impairment Battery Short Form; DSB, Digit span backward; DSF, Digit span forward; 6MWT, 6-minute walk test; HHD, Handheld dynamometer; TUG, Timed up and go test; CSDD, Cornell Scale for Depression in Dementia; CMAI, Cohen-Mansfield Agitation Inventory; AES, Apathy Evaluation Scale-10.

Table 2. Univariable linear mixed regression analyses of associations between predictors and CDS and E-ADL

	CDS (N = 75)				E-ADL (N = 75)			
Predictor	**B (95%CI)**	**β**	***R²***	***p***	**B (95%CI)**	**β**	***R²***	***p***
Age	-0.44 (-0.88, 0.00)	-0.22	0.12	0.05	-0.26 (-0.55, -0.03)	-0.21	0.04	0.08
Gender	-2.95 (-9.12, 3.23)	-0.11	0.08	0.34	1.06 (-2.99, 5.11)	0.07	0.01	0.60
Comorbidities	-1.36 (-2.67, 0.05)	-0.24	0.14	0.04	-0.38 (-1.23, 0.48)	-0.10	0.00	0.38
HHD	0.62 (0.33, 0.91)	0.46	0.24	<0.001	0.28 (0.08, 0.48)	0.33	0.11	0.009
6MWT	0.10 (0.07, 0.13)	0.66	0.46	<0.001	0.03 (0.01, 0.05)	0.31	0.07	0.02
TUG	-0.37 (-0.56, -0.17)	-0.39	0.25	<0.001	-0.16 (-0.30, -0.03)	-0.27	0.06	0.02
MMSE	0.95 (0.53, 1.37)	0.46	0.24	<0.001	0.90 (0.68, 1.13)	0.69	0.47	<0.001
SIB-S	0.46 (0.13, 0.79)	0.31	0.14	0.007	0.72 (0.58, 0.87)	0.76	0.57	<0.001
CSDD	-0.63 (-1.19, -0.07)	-0.25	0.13	0.03	-0.16 (-0.53, 0.21)	-0.10	0.00	0.40
CMAI	-0.14 (-0.32, 0.04)	-0.18	0.08	0.12	-0.13 (-0.24, -0.01)	-0.26	0.05	0.03
AES	-1.03 (-1.30, -0.77)	-0.67	0.46	<0.001	-0.33 (-0.55, -0.11)	-0.33	0.10	0.004

Abbreviations. B, unstandardized regression coefficient; β, standardized regression coefficient; CDS, Care dependency scale; E-ADL, Erlangen activities of daily living; MMSE, Mini-Mental State Examination; SIB-S, Severe Impairment Battery Short Form; DSB, Digit span backward; DSF, Digit span forward; 6MWT, 6-minute walk test; HHD, Handheld dynamometer; TUG, Timed up and go test; Balance: Z-score of Figure of eight test and the Frailty and Injuries: Cooperative Studies of Intervention Techniques- 4 scale; CSDD, Cornell Scale for Depression in Dementia; CMAI, Cohen-Mansfield Agitation Inventory; AES, Apathy Evaluation Scale-10.

Table 3. Multiple linear mixed regression analysis predicting CDS and E-ADL (N = 75)

	B (95%CI)	**β**	***p***	***Adjusted R²***
CDS				0.66
AES	-0.67 (-0.92, -0.42)	-0.43	<0.001	
6MWT	0.06 (0.03, 0.08)	0.40	<0.001	
Comorbidities	-1.12 (-1.95, -0.29)	-0.19	0.009	
MMSE	0.36 (0.04, 0.68)	0.18	0.026	
E-ADL				0.60
SIB-S	0.52 (0.30, 0.74)	0.55	<0.001	
MMSE	0.37 (0.08, 0.67)	0.28	0.014	

Abbreviations. B, unstandardized regression coefficient; β, standardized regression coefficient; CDS, Care dependency scale; E-ADL, Erlangen activities of daily living; AES, Apathy Evaluation Scale-10; 6MWT, 6-minute walk test; MMSE, Mini-Mental State Examination; HHD, Handheld dynamometer.

Subgroup analysis

Care Dependency Scale (CDS)

An additional subgroup analysis was performed with 59 participants which also included EF tasks, balance, and educational level. In the simple regression analyses, significant associations were found for ten predictor variables and the CDS score. Apathy (β = -0.72) and 6MWT (β = 0.68) showed the strongest associations **(supplementary table)**. In the multiple regression analyses, apathy (β = -0.47), 6MWT (β = 0.34), handgrip strength (β = 0.23), and category fluency (β = 0.16) were significant, independent predictors of CDS **(Table 4).** The model predicted 75% of variation in CDS score. Apathy and the 6MWT remained the most important predictors of the CDS score.

E-ADL

In the simple regression analyses, significant associations were found for nine predictor variables and the E-ADL score. MMSE (β = 0.62) and the SIB-S (β = 0.72) showed the strongest associations **(supplementary table)**. In the multiple regression analyses, SIB-S (β = 0.52), MMSE (β = 0.27), and age (β = 0.19) were significant, independent predictors of E-ADL **(Table 4).** Fifty-eight percent of the variance in E-ADL was accounted for by the full model. The SIB-S was the most important predictor of E-ADL.

Table 4. Multiple linear mixed regression analysis predicting CDS and E-ADL in a subgroup

	B (95%CI)	β	*p*	*Adjusted R²*
CDS[a] (n = 59)				0.75
AES	-0.74 (-0.99, -0.49)	-0.47	<0.001	
6MWT	0.05 (0.03, 0.08)	0.34	<0.001	
HHD	0.30 (0.09, 0.51)	0.23	0.006	
Category Fluency	0.58 (0.04, 1.11)	0.16	0.034	
E-ADL[b] (n = 59)				0.58
SIB-S	0.59 (0.33, 0.85)	0.52	<0.001	
MMSE	0.36 (0.06, 0.67)	0.27	0.021	
Age	-0.21 (-0.41, -0.02)	0.19	0.031	

Note. [a]significant univariable associations: age, HHD, 6MWT, TUG, MMSE, SIB-S, AES, GIT, DSB, balance; [b]significant univariable associations: age, HHD, 6MWT, TUG, MMSE, SIB-S, GIT, DSB, balance.
Abbreviations. B, unstandardized regression coefficient; β, standardized regression coefficient; CDS, Care dependency scale; E-ADL, Erlangen activities of daily living; AES, Apathy Evaluation Scale-10; 6MWT, 6-minute walk test; HHD, Handheld dynamometer; SIB-S, Severe Impairment Battery Short form; MMSE, Mini-Mental State Examination.

DISCUSSION

The current study showed that apathy, lower physical endurance, higher number of comorbidities, and global cognition are important predictors of care dependency. These predictors explained 66% of the observed variance in care dependency in NH residents with moderate to severe dementia. These results both support and extend previous literature reporting associations between care dependency and physical,[23] cognitive,[20, 57] and neuropsychiatric predictors.[11, 58, 59] In our study, apathy and physical endurance were most predictive of care dependency. A previous study examining a cohort with mild to moderate dementia found that neuropsychiatric symptoms were correlated with dependence, but had only limited power to explain its variance.[16] This discrepancy with the current study may be explained by the fact that we examined NH residents at a more severe stage of dementia who were more dependent and had more neuropsychiatric problems than participants in other studies.[16] The large role which apathy plays in predicting care dependency is reasonable inasmuch as apathy manifests as a lack of motivation, taking initiative, and goal-directed behavior. Impairment in these functions may prevent patients from performing self-care activities.[60] These results suggest that interventions targeted at reducing apathy may in turn benefit care dependency. Previous research has provided evidence of the effectiveness of individually tailored therapeutic activities for reducing apathy in dementia.[61]

In addition to apathy, physical endurance emerged as one of the most important predictors of care dependency. This was to be expected considering the involvement of motor skills in many self-care tasks (e.g., dressing, eating, continence).[27] Other physical functions, such as handgrip strength and functional mobility, were individually associated with care dependency, but not when other factors were taken into account. These results suggest that physical endurance is a stronger predictor of care dependency than other physical factors, emphasizing the importance of stimulating physical activity to keep the physical endurance optimal, even in advanced stages of dementia. However, despite emerging evidence for the benefits of physical activity interventions in persons with dementia, uncertainty remains regarding the optimal type, intensity, duration, and frequency of exercise.[62, 63] Further, it was found that the total number of comorbidities significantly predicted care dependency. This finding suggests that particular attention should be given to individuals with dementia who have multiple other medical conditions, as they may be at risk for increased care dependency.

With regard to ADL ability, this study showed that global cognition was the most important predictor. This may be explained by the nature of the E-ADL task, which measures a sequence of actions relevant to self-care. Understanding the test instructions and executing the sequences depends on the level of cognitive abilities. The large proportion of variance in ADL ability which was explained by global cognition (60%) is more than reported in previous studies (20-26%).[64, 65]

There are two possible explanations for this difference. First, previous studies typically included only caregiver-rated assessments of ADL disability,[14, 18, 60, 66, 67] which may produce different estimates of ADL disability than performance-based assessments.[68] Second, unlike previous studies that used only the MMSE, we also used the SIB-S to measure global cognition. The SIB-S may be a better predictor of ADL disability than the MMSE as it is a broader scale,[69] and more sensitive to the measurement of cognitive functioning in persons with a MMSE score below 12.[69]

Results from the subgroup analyses suggest that besides apathy and physical predictors, executive functions (i.e., category fluency) may play an important role in predicting care dependency. This is in line with previous studies which demonstrated a consistent moderate relationship between EF and functional dependence.[1, 60] The category fluency task is a measure of executive control ability. Important components of executive control ability are set-shifting (i.e., the ability to flexibly switch between tasks), goal-directed behavior, and self-initiation. Deficits in these abilities may negatively influence the ability to function independently.[70] With regard to ADL ability, the subgroup analyses showed that global cognition remained the most important predictor of E-ADL, even when executive functions were also considered. Global cognition together with age explained 58% of the variance in E-ADL. Although the subgroup analyses must be interpreted cautiously due to the limited sample size, the results suggest that EF contributes to the prediction of care dependency, highlighting the relevance to further examine the relative contribution of EF in a larger sample.

Strengths of this study were the inclusion of a broad range of predictors, the inclusion of participants with moderate to severe dementia, and the use of outcome measures specifically designed and validated for use in NH residents with dementia. A limitation of our study was the amount of missing data. Considering the nature of the missing data, multiple imputations would not have been fully reliable. For this reason, the subgroup analyses which included EF tasks were restricted to participants with higher cognitive abilities, which in turn may limit the generalization of our results. A second limitation is that the study was cross-sectional in design, which restricts the ability to draw causal inferences. Third, information regarding the presence of comorbid nursing care problems (e.g., incontinence, malnutrition, restraints, falls, and pressure ulcers) was not collected. These nursing care problems are common in NH residents with dementia and are related to care dependency.[8, 13, 71] Therefore, the presence and influence of nursing care problems should be considered in future research. In addition, the NH setting may influence care dependency, as there may be differences in care management between NH locations. However, we controlled for this by examining the nested structure of the data. Related, for some participants, the same caregiver rated the CDS, as well as the questionnaires (i.e., depression, apathy, and agitation). This may have artificially inflated the beta coefficients.

In conclusion, our results showed that care dependency is affected by multiple predictors, including apathy, physical endurance, number of comorbidities, and cognitive functions. Previous studies showed that apathetic persons with dementia suffer more rapid cognitive and functional decline than persons without apathy.[72] It is possible that apathetic, cognitive, and physical problems reinforce each other thereby causing more dependency, as the ability to understand and execute self-care tasks depends on cognitive functions, physical capabilities, and the ability to take initiative. The results of the present study suggest that NH residents with dementia are more care dependent if they are apathetic, have worse cognitive function, and worse physical function.

The results of this study are clinically relevant, as NH residents with dementia have a high level of care dependency.[13, 71, 73] An improved understanding of the predictors of care dependency is particularly relevant for the development of interventions designed to maintain the residents' highest levels of independence. The results advocate a multidisciplinary approach for interventions to stabilize care dependency, as interventions focusing on a single predictor may be less effective considering that multiple factors contribute to care dependency. Future research could focus on the effectiveness of multifactorial interventions such as individually tailored therapeutic interventions which focus on reducing apathy, as well as stimulating physical and cognitive performance. In addition, proper treatment and efforts to stabilize medical comorbidities in the NH population may benefit care dependency.

REFERENCES

1. Martyr A, Clare L. Executive function and activities of daily living in Alzheimer's disease: a correlational meta-analysis. *Dement. Geriatr. Cogn. Disord.* 2012; 33(2-3):189-203.
2. Carpenter GI, Hastie CL, Morris JN, Fries BE, Ankri J. Measuring change in activities of daily living in nursing home residents with moderate to severe cognitive impairment. *BMC Geriatr.* 2006;6(1):7.
3. Lee TW, Cho E, Yim ES, et al. Activities of daily living in nursing home and home care settings: A retrospective 1-year cohort study. *J. Am. Med. Dir. Assoc.* 2015;16(2):114-119.
4. Meinerding M, DeFeis B, Sunderaraman P, et al. Assessing Dependency in a Multiethnic Community Cohort of Individuals With Alzheimer's Disease. *Innovation Aging.* 2018;2(1):igy011.
5. Dijkstra A, Buist G, Dassen T. Operationalization of the concept of'nursing care dependency'for use in long-term care facilities. *Aust. N. Z. J. Ment. Health Nurs.* 1998;7:142-151.
6. Picco L, Abdin E, Vaingankar JA, et al. Prevalence and Risk Factors of Caregiver Dependence among Older Adults in a Southeast Asian Population. *Ann. Acad. Med. Singap.* 2016;45(11):486-494.
7. Schüssler S, Lohrmann C. *Dementia in Nursing Homes*: Springer; 2017.
8. Schüssler S, Dassen T, Lohrmann C. Prevalence of care dependency and nursing care problems in nursing home residents with dementia: a literature review. *Int. J. Caring. Sci.* 2014;7(2):338-352.
9. Ballard C, O'Brien J, James I, et al. Quality of life for people with dementia living in residential and nursing home care: the impact of performance on activities of daily living, behavioral and psychological symptoms, language skills, and psychotropic drugs. *Int. Psychogeriatr.* 2001;13(1):93-106.
10. Garre-Olmo J, Vilalta-Franch J, Calvó-Perxas L, López-Pousa S, Group C-AS. A Path Analysis of Dependence and Quality of Life in Alzheimer's Disease. *Am. J. Alzheimers Dis. Other Demen.* 2017;32(2):108-115.
11. Gallagher D, Ni Mhaolain A, Crosby L, et al. Dependence and caregiver burden in Alzheimer's disease and mild cognitive impairment. *Am. J. Alzheimers Dis. Other Demen.* 2011;26(2):110-114.
12. Giebel CM, Challis DJ, Montaldi D. A revised interview for deterioration in daily living activities in dementia reveals the relationship between social activities and well-being. *Dementia.* 2016; 15(5): 1068-1081.
13. Schüssler S, Dassen T, Lohrmann C. Care dependency and nursing care problems in nursing home residents with and without dementia: a cross-sectional study. *Aging Clin. Exp. Res.* 2016;28(5):973-982.
14. Benke T, Delazer M, Sanin G, et al. Cognition, gender, and functional abilities in Alzheimer's disease: how are they related? *J. Alzheimers Dis.* 2013;3 5(2): 247-252.
15. Hill RD, Bäckman L, Fratiglioni L. Determinants of functional abilities in dementia. *J. Am. Geriatr. Soc.* 1995;43(10):1092-1097.
16. Benke T, Sanin G, Lechner A, et al. Predictors of Patient Dependence in Mild-to-Moderate Alzheimer's Disease. *J. Alzheimers Dis.* 2015;43(2):443-449.
17. Caljouw MA, Cools HJ, Gussekloo J. Natural course of care dependency in residents of long-term care facilities: prospective follow-up study. *BMC Geriatr.* 2014;14(1):67.
18. Van Rossum M, Koek H. Predictors of functional disability in mild cognitive impairment and dementia. *Maturitas.* 2016;90:31-36.
19. Holtzer R, Wegesin DJ, Albert SM, et al. The rate of cognitive decline and risk of reaching clinical milestones in Alzheimer disease. *Arch. Neurol.* 2003;60(8):1137-1142.

20. Caro J, Ward A, Ishak K, et al. To what degree does cognitive impairment in Alzheimer's disease predict dependence of patients on caregivers? *BMC Neurol.* 2002;2(1):6.
21. Marshall GA, Rentz DM, Frey MT, Locascio JJ, Johnson KA, Sperling RA. Executive function and instrumental activities of daily living in mild cognitive impairment and Alzheimer's disease. *Alzheimers Dement.* 2011;7(3):300-308.
22. Nygard L, Amberla K, Bernspång B, Almkvist O, Winblad B. The relationship between cognition and daily activities in cases of mild Alzheimer's disease. *Scand. J. Occup. Ther.* 1998;5(4):160-166.
23. Spackman DE, Kadiyala S, Neumann PJ, Veenstra DL, Sullivan SD. The validity of dependence as a health outcome measure in Alzheimer's disease. *Am. J. Alzheimers Dis. Other Demen.* 2013;28(3):245-252.
24. Kim EJ. Factors influencing care dependency in patients with dementia. *J. Korean Acad. Nurs.* 2003;33(6):705-712.
25. Boyle PA, Malloy PF, Salloway S, Cahn-Weiner DA, Cohen R, Cummings JL. Executive dysfunction and apathy predict functional impairment in Alzheimer disease. *Am. J. Geriatr. Psychiatry.* 2003;11(2):214-221.
26. Zanetti O, Bianchetti A, Frisoni GB, Rozzini R, Trabucchi M. Determinants of disability in Alzheimer's disease. *Int. J. Geriatr. Psychiatry.* 1993;8(7):581-586.
27. Marra T, Pereira L, Faria C, Pereira D, Martins M, Tirado M. Evaluation of the activities of daily living of the elderly with different levels of dementia. *Rev. Bras. Fisioter.* 2007;11(4):235-240.
28. Giebel CM, Sutcliffe C, Challis D. Activities of daily living and quality of life across different stages of dementia: a UK study. *Aging Ment. Health.* 2015;19(1):63-71.
29. Henskens M, Nauta IM, Drost KT, Scherder EJA. The effects of movement stimulation on activities of daily living performance and quality of life in nursing home residents with dementia: a randomized controlled trial. *Clin. Int. Aging.* 2018;13:805
30. Huntleigh A. ARJO Guidebook for Architects and Planners: Elderly Care Facilities: ARJO Hospital equipment: *ARJO Hospital Equipment*; 2005.
31. Folstein MF, Folstein SE, McHugh PR. "Mini-mental state": a practical method for grading the cognitive state of patients for the clinician. *J. Psychiatr. Res.* 1975;12(3):189-198.
32. Rikli RE, Jones CJ. The reliability and validity of a 6-minute walk test as a measure of physical endurance in older adults. *J. Aging Phys. Act.* 1998; 6(4): 363-375.
33. Dijkstra A, Buist G, Dassen T. Nursing-Care Dependency. *Scand. J. Caring Sci.* 1996;10(3):137-143.
34. Dijkstra A, Buist G, Moorer P, Dassen T. Construct validity of the nursing care dependency scale. *J. Clin. Nurs.* 1999;8(4):380-388.
35. Dijkstra A, White M, Smith J. Measuring care dependency with the Care Dependency Scale (CDS)-a manual. *Noordelijk Centrum voor Gezondheidsvraagstukken,* Groningen. 2006.
36. Graessel E, Viegas R, Stemmer R, Küchly B, Kornhuber J, Donath C. The Erlangen Test of Activities of Daily Living: first results on reliability and validity of a short performance test to measure fundamental activities of daily living in dementia patients. *Int. Psychogeriatr.* 2009;21(1): 103-112.
37. Verhage F. Intelligentie en leeftijd: Onderzoek bij Nederlanders van twaalf tot zevenenzeventig jaar: *Van Gorcum*; 1964.
38. Centers for Medicare & Medicaid Services. Revised long-term care facility resident assessment instrument user's manual version 2.0. *Baltimore: CMS.* 2008.

39. Saxton J, Kastango KB, Hugonot-Diener L, et al. Development of a Short Form of the Severe Impairment Battery. *Am. J. Geriatr. Psychiatry.* 2005;13(11):999-1005.
40. Tombaugh TN, McIntyre NJ. The mini-mental state examination: a comprehensive review. *J. Am. Geriatr. Soc.* 1992;40(9):922-935.
41. De Jonghe JF, Wetzels RB, Mulders A, Zuidema SU, Koopmans RT. Validity of the severe impairment battery short version. *J. Neurol. Neurosurg. Psychaitry.* 2009.
42. Snijders JT, Verhage F. Groninger intelligentie test: *Swets & Zeitlinger*; Lisse. 1983.
43. Wechsler D. *WMS-R: Wechsler Memory Scale-Revised*: *Psychological Corporation*; 1987.
44. Podsiadlo D, Richardson S. The timed "Up & Go": a test of basic functional mobility for frail elderly persons. *J. Am. Geriatr. Soc.* 1991;39(2):142-148.
45. Schaubert KL, Bohannon RW. Reliability and validity of three strength measures obtained from community-dwelling elderly persons. *J. Strength Cond. Res.* 2005;19(3):717-720.
46. Hess RJ, Brach JS, Piva SR, VanSwearingen JM. Walking skill can be assessed in older adults: validity of the Figure-of-8 Walk Test. *Phys. Ther.* 2010;90(1):89-99.
47. Rossiter-Fornoff JE, Wolf SL, Wolfson LI, Buchner DM, Group F. A cross-sectional validation study of the FICSIT common data base static balance measures. *J. Gerontol. A. Biol. Sci. Med. Sci.* 1995;50(6):M291-M297.
48. Droës R. Dutch translation of the Cornell-Scale for Depression in Dementia. *VU University.* Amsterdam. 1993.
49. Leontjevas R, Gerritsen DL, Vernooij-Dassen MJ, Smalbrugge M, Koopmans RT. Comparative validation of proxy-based Montgomery-Åsberg depression rating scale and cornell scale for depression in dementia in nursing home residents with dementia. *Am. J. Geriatr. Psychiatry.* 2012;20(11):985-993.
50. Alexopoulos GS, Abrams RC, Young RC, Shamoian CA. Cornell scale for depression in dementia. *Biol. Psychiatry.* 1988;23(3):271-284.
51. Lueken U, Seidl U, Völker L, Schweiger E, Kruse A, Schröder J. Development of a short version of the Apathy Evaluation Scale specifically adapted for demented nursing home residents. *Am. J. Geriatr. Psychiatry.* 2007;15(5):376-385.
52. Leontjevas R, Evers-Stephan A, Smalbrugge M, et al. A comparative validation of the abbreviated apathy evaluation scale (AES-10) with the neuropsychiatric inventory apathy subscale against diagnostic criteria of apathy. *J. Am. Med. Dir. Assoc.* 2012;13(308):e301-308.
53. Cohen-Mansfield J, Marx MS, Rosenthal AS. A description of agitation in a nursing home. *J. Gerontol.* 1989;44(3):M77-M84.
54. Jonghe JF, Kat MG. Factor structure and validity of the Dutch version of the Cohen-Mansfield Agitation Inventory (CMAI-D). *J. Am. Geriatr. Soc.* 1996;44(7):888-889.
55. Shah A, Evans H, Parkash N. Evaluation of three aggression/agitation behaviour rating scales for use on an acute admission and assessment psychogeriatric ward. *Int. J. Geriatr. Psychiatry.* 1998;13(6): 415-420.
56. Dijkstra A, Buist A, Dassen T, Van den Heuvel W. Het meten van zorgafhankelijkheid met de ZorgAfhankelijkheidsSchaal (ZAS): een handleiding (The Measurement of care dependency with the Care Dependency Scale (CDS): A Manual). *Research Institute SHARE, UMCG/Rijksuniversiteit.* Groningen. 2012.
57. Stern Y, Albert SM, Sano M, et al. Assessing patient dependence in Alzheimer's disease. *J. Gerontol.* 1994;49(5):M216-M222.
58. Murman DL, Von Eye A, Sherwood PR, Liang J, Colenda CC. Evaluated need, costs of care, and payer perspective in degenerative dementia patients cared for in the United States. *Alzheimer Dis. Assoc. Disord.* 2007;21(1):39-48.

59. Zahodne LB, Ornstein K, Cosentino S, Devanand DP, Stern Y. Longitudinal relationships between Alzheimer disease progression and psychosis, depressed mood, and agitation/aggression. *Am. J. Geriatr. Psychiatry.* 2015;23(2):130-140.
60. Burton RL, O'Connell ME, Morgan DG. Cognitive and Neuropsychiatric Correlates of Functional Impairment Across the Continuum of No Cognitive Impairment to Dementia. *Arch. Clin. Neuropsychol.* 2017:1-13.
61. Brodaty H, Burns K. Nonpharmacological management of apathy in dementia: a systematic review. *Am. J. Geriatr. Psychiatry.* 2012;20(7):549-564.
62. Forbes D, Forbes SC, Blake CM, Thiessen EJ, Forbes S. Exercise programs for people with dementia. *The Cochrane Library.* 2015.
63. Brett L, Traynor V, Stapley P. Effects of physical exercise on health and well-being of individuals living with a dementia in nursing homes: A systematic review. *J. Am. Med. Dir. Assoc.* 2016;17(2):104-116.
64. Royall DR, Lauterbach EC, Kaufer D, Malloy P, Coburn KL, Black KJ. The cognitive correlates of functional status: a review from the Committee on Research of the American Neuropsychiatric Association. *J. Neuropsychiatry Clin. Neurosc.* 2007;19(3):249-265.
65. Mcalister C, Schmitter-Edgecombe M, Lamb R. Examination of variables that may affect the relationship between cognition and functional status in individuals with mild cognitive impairment: A meta-analysis. *Arch. Clin. Neuropsychol.* 2016;31(2):123-147.
66. Hesseberg K, Bentzen H, Ranhoff AH, Engedal K, Bergland A. Disability in instrumental activities of daily living in elderly patients with mild cognitive impairment and Alzheimer's disease. *Dement. Geriatr. Cogn. Disord.* 2013; 36(3-4):146-153.
67. Vallotti B, Mossello E, Cantini C, et al. Determinants of functional status in Alzheimer's disease and vascular dementia. *Arch. Gerontol. Geriatr.* 2001;33:419-428.
68. Gold DA. An examination of instrumental activities of daily living assessment in older adults and mild cognitive impairment. *J. Clin. Exp. Neuropsychol.* 2012;34(1):11-34.
69. Panisset M, Roudier M, Saxton J, Boiler F. Severe impairment battery: a neuropsychological test for severely demented patients. *Arch Neurol.* 1994;51(1):41-45.
70. Shao Z, Janse E, Visser K, Meyer AS. What do verbal fluency tasks measure? Predictors of verbal fluency performance in older adults. *Front. Psychol.* 2014;5:772.
71. Schüssler S, Dassen T, Lohrmann C. Comparison of care dependency and related nursing care problems between Austrian nursing home residents with and without dementia. *Euro. Geriatr. Med.* 2015;6(1):46-52.
72. Starkstein S, Jorge R, Mizrahi R, Robinson R. A prospective longitudinal study of apathy in Alzheimer's disease. *J. Neurol. Neurosurg. Psychiatry.* 2006;77(1):8-11.
73. Dijkstra A, Sipsma D, Dassen T. Predictors of care dependency in Alzheimer's disease after a two-year period. *Int. J. Nurs. Stud.* 1999;36(6):487-495.

Supplementary table. Univariable linear mixed regression analyses of associations between predictors and CDS and E-ADL in a subgroup (n=59)

	CDS (n = 59)				E-ADL (n = 59)			
Predictor	**B (95%CI)**	**β**	***R²***	***p***	**B (95%CI)**	**β**	***R²***	***p***
Age	-0.42 (-0.89, 0.06)	-0.23	0.08	0.08	-0.33 (-0.60, -0.05)	-0.30	0.07	0.02
Gender	-3.52 (-10.65, 3.61)	-0.13	0.05	0.34	1.32 (-2.96, 5.59)	0.08	0.01	0.54
Level of education[a]								
Medium vs. low	1.78 (-4.32, 7.88)	0.08	0.07	0.56	2.15 (-1.58, 5.89)	0.16	0.00	0.25
High vs. low	-9.90 (-22.45, 2.65)	-0.33	0.00	0.12	2.58 (-5.02, 10.17)	0.16	0.01	0.49
Comorbidities	-1.04 (-2.47, 0.40)	-0.19	0.09	0.16	-0.43 (-1.29, 0.42)	-0.13	0.00	0.32
HHD	0.59 (0.27, 0.92)	0.46	0.22	0.001	0.18 (0.02, 0.38)	0.24	0.04	0.07
6MWT	0.10 (0.07, 0.13)	0.68	0.49	<0.001	0.03 (0.01, 0.05)	0.35	0.09	0.01
TUG	-0.33 (-0.54, -0.13)	-0.38	0.13	0.002	-0.16 (-0.29, -0.03)	-0.31	0.08	0.02
MMSE	1.01 (0.48, 1.55)	0.45	0.22	<0.001	0.83 (0.55, 1.11)	0.62	0.37	<0.001
SIB-S	0.45 (0.04, 0.94)	0.24	0.08	0.07	0.82 (0.61, 1.03)	0.72	0.51	<0.001
CSDD	-0.42 (-1.15, -0.32)	-0.15	0.06	0.26	0.00 (-0.45, 0.44)	0.00	0.02	0.99
CMAI	-0.06 (-0.30, 0.18)	-0.07	0.04	0.64	-0.06 (-0.20, -0.09)	-0.11	0.01	0.44
AES	-1.14 (-1.43, -0.85)	-0.72	0.53	<0.001	-0.20 (-0.45, -0.39)	-0.21	0.03	0.10
Category Fluency	1.60 (0.72, 2.47)	0.43	0.22	0.001	1.01 (0.49, 1.53)	0.46	0.20	<0.001
DSB	1.30 (-0.04, 2.64)	0.24	0.11	0.06	1.43 (0.69, 2.18)	0.45	0.19	<0.001
Balance	5.50 (2.48, 8.52)	0.44	0.24	0.001	2.20 (0.30, 4.10)	0.29	0.07	0.02

Note. [a]Low education was used as reference group.
Abbreviations. B, unstandardized regression coefficient; β, standardized regression coefficient; CDS, Care dependency scale; E-ADL, Erlangen activities of daily living; MMSE, Mini-Mental State Examination; SIB-S, Severe Impairment Battery Short Form; DSB, Digit span backward; DSF, Digit span forward; 6MWT, 6-minute walk test; HHD, Handheld dynamometer; TUG, Timed up and go test; Balance: Z-score of Figure of eight test and the Frailty and Injuries: Cooperative Studies of Intervention Techniques- 4 scale; CSDD, Cornell Scale for Depression in Dementia; CMAI, Cohen-Mansfield Agitation Inventory; AES, Apathy Evaluation Scale-10.